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ABSTRACT

The use of technology in training has grown tremendously. Tools commonly being used include computer-based training systems, multimedia systems, electronic performance support systems, and telecommunications systems for distance learning. The use of technology-based delivery systems in training has many potential benefits for organizations, but the trainers using the systems must possess the skills needed to effectively utilize the technology. This study provides information on the implementation of instructional technology in employee training and the competencies needed by trainers to utilize instructional technology in their jobs. Results of the study show that the major types of instructional technology used in training and development will not change dramatically over the rest of the 1990s. There will be greater use of interactive technologies, and more companies will use digital multimedia technologies and individualized performance support systems to provide flexible training opportunities. It is more important for trainers to be able to use and evaluate new technologies than to be able to design them; program or system development is usually done by computer programmers or media specialists. Vendor-sponsored training and self-study methods are the primary sources of competency development in instructional technology. The major barriers to implementing instructional technology in training programs are lack of time and financial resources. Lack of compatibility between systems, management support, technical support, and trainer skills are also significant barriers. The study did not find a lack of trainee interest in using instructional technology or a lack of support for training efforts. Included are recommendations for practitioners and training providers. (Contains 18 references.) (Author/SWC)

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Title:

Competencies Needed to Design and Deliver Training Using Instructional Technology

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Training professionals perform in a great variety of roles as they apply their competencies to the human resource development challenges facing their organizations (McLagan, 1989). Two primary duties of trainers include designing and delivering instruction. Each of these duties is becoming more challenging as technology evolves. The use of technology in training has grown tremendously over the past five years; tools have improved and have produced several changes in the way training is being designed and delivered (Haag, 1993). Contemporary design and delivery systems include computer-based training systems, multimedia systems, electronic performance support systems and telecommunication systems for distance learning. In addition, computer technology is being used to enhance traditional classroom training.

Although not every organization has implemented these new design and delivery systems, the number of organizations using these systems increases each year. A recent survey of organizations with more than 100 employees indicated that 48% are using computer-based training, 27% are using multimedia systems and 43% are using some type of distance learning system to deliver training (Industry Report, 1995).

The use of technology-based delivery systems in the training process has many potential benefits for organizations. For example, the use of computer-based technology in the design and delivery of training can result in greater learning gains, more consistent and acceptable job performance, enhanced cost-effectiveness and greater flexibility regarding the time and locations of training (Hannum, 1990). Several research studies have concluded that, under the right circumstances, computer-based delivery systems are considerably more cost effective than classroom training and produce learning that is at least equal to what can be achieved in a classroom (Haag, 1993). Technology can also help when addressing the needs of geographically-dispersed trainees and in reducing the need for classroom facilities (Perlstein, 1993).

However, the value derived from the use of technology in training is not due to the hardware itself but rather to the instructional processes that technology can support (Hannum, 1990). To be effective in their positions, today's trainers must possess competencies needed to perform in an increasingly technological environment. They must have a solid understanding of learning theories and methodologies and be able to apply this knowledge to the development and delivery of training using computer-based technologies, distance learning systems and other types of instructional technology (Hannum, 1990). Trainers who lack these skills may be limiting their effectiveness and their ability to obtain positions or advance in many areas of the field.

Developing and maintaining expertise in instructional technology can be a challenge to trainers for many reasons. Because instructional technology is an emerging field, many of the concepts associated with this field, including "multimedia" or "distance learning," have taken on a wide range of meanings, resulting in confusion for practitioners (Anglin, 1991). Also, because many of these technologies are still evolving, there are few standards in the field. The hardware and software associated with these technologies is continually being changed, upgraded or replaced. It is often difficult for both new and experienced trainers to design, develop and implement hardware and software in a timely manner when the technology environment is dynamic and the rate of obsolescence is increasing (Anglin, 1991). Finally, many trainers who have spent several years using traditional training methods and media may resist or feel uncomfortable with new technology (Schaaf, 1992).

There is a need for a better understanding of the competencies required by trainers regarding the use of new technologies in training and how these competencies may be developed. Although there have been several needs assessments conducted to identify the competencies of trainers, including the American Society for Training and Development's *Models for HRD Practice* and the competency studies published by the International Board of Standards for Training, Performance and Instruction, typically, studies of this type do not provide any detailed information about the competencies needed to use specific types of hardware, software or delivery systems.

Currently, there are several resources that could provide training to trainers who need to develop their knowledge, skills and abilities in designing and delivering instruction using contemporary instructional technology. These resources include undergraduate and graduate courses at colleges and universities; courses, workshops and certificate programs offered by trade schools or technical colleges; and conferences and seminars offered by professional associations (Lindstrom, 1994). Many hardware and software vendors also provide training to organizations that purchase their equipment and products. Finally, trainers can train themselves using training courseware, computer tutorials, videotapes, books and manuals (Lindstrom, 1994). However, because these programs and resources are relatively new, no statistics exist regarding the percentage of trainers who complete formal or self-paced programs or how successful these programs are in meeting the needs of trainers.

In addition, even trainers who are highly skilled in the use of instructional technology may experience difficulty when implementing new types of delivery systems in the work environment. There are often barriers in organizations that inhibit the successful implementation of instructional technology in training. These barriers may include high

costs, lack of management support, lack of trainer skills, cultural defaults for the classroom experience and failure to identify needs adequately (Gery, 1994).

Statement of the Problem

Little is known about the nature of the challenges encountered by trainers as they attempt to incorporate computer-based technologies and distance learning systems into their training processes and programs. Few studies have examined the impact of these technologies on the role of the trainer.

Purpose of the Study

The purpose of this study is to provide current information on the implementation of instructional technology in employee training and the competencies needed by trainers to utilize instructional technology in their jobs. This information may be used to assist training professionals in determining their continuing education or training needs in the area of instructional technology. The information also may be used by universities, professional organizations and others who provide degree programs in human resource development or instructional technology in developing relevant curricula.

Research Questions

This study sought to find answers to the following questions:

1. What types of computer-based technologies and distance learning systems are being used to deliver training in business and industry?
2. What types of computer-based technologies and distance learning systems will be used to deliver training in the future?
3. What are the competencies that are needed for trainers to deliver instruction using computer-based technologies and distance learning systems?
4. Where are trainers obtaining the competencies that are needed to deliver instruction using computer-based technologies and distance learning systems?
5. What barriers exist in the workplace that prevent trainers from using computer-based technologies and distance learning systems to deliver training in the workplace?

Significance of the Study

Technology has dramatically changed the way can be which training is designed and delivered. These technological trends necessitate that training professionals learn new job skills (Lindstrom, 1994). This study was designed to benefit training professionals, human resource development managers, academicians and other training providers by providing practical, timely information that may be used to update trainer skills and training programs. This study will provide current information on the implementation of instructional technology in training efforts at a time when it is crucial for trainers to expand their repertoire of skills in this area.

In order to best prepare training professionals with the necessary knowledge, skills and competencies, training providers need to have an accurate picture of the current skill requirements (Morlan & Lu, 1994). The findings of this study may be used by universities and other organizations to develop and revise degree programs, courses, seminars, workshops, and self-study materials to meet the instructional technology training needs of human resource development professionals.

Methodology

This study was conducted during a six-month period from June to December in 1994. First, a literature review focusing on the use of instructional technology in training was conducted. Next, a questionnaire was developed by the researcher and reviewed by a group of eight trainers, research consultants and experts in the field of instructional technology. The first section of the survey was to contain demographic items, including job title of respondent, type of

organization and size of organization where the respondent is employed. In the second section, respondents were to identify (a) how technology is currently being used to design and deliver training in their organizations, (b) their perceptions of the types of technology that will be used to design and deliver training in the future, (c) the level of competency required of trainers in each type of technology, and (d) sources of competency development in each technology In the third section of the survey, respondents were asked to identify barriers in the workplace which limited the implementation of instructional technology in training.

Population and Sample

This study was designed to determine the perceptions of training professionals regarding the use of technology in the design and delivery of instruction. The population selected for this study included members of the National Society for Performance and Instruction, specifically those members living and/or working in the following Midwestern states: Illinois, Iowa, Michigan, Minnesota and Wisconsin. This group was selected over the other professional training associations because of its focus on performance technology. The association's 1993-94 national membership directory was used to obtain a list of members of the population for this study. In this directory, members were listed alphabetically by state. In the five Midwestern states included in the study, there were a total of 1,093 members. A systematic sample of members was selected. This method of sampling is appropriate when a list of elements is available and when the list is arranged in a manner that will not interfere with the purpose of the study (Babbie, 1990). This method also assured that a proportional number of individuals from each of the five states would be included in the sample.

The following steps were taken to determine the size of the sample. First, a decision was made to establish a confidence level of 95% (0.95) for the results of the study. Then the formula outlined in *How to Determine Appropriate Survey Sample Size* (Narins, 1994) was applied to calculate the appropriate sample size for the population. For a population of 1,093, a sample of 381 was required to produce the desired confidence level. This method of determining sample size was generous and provided latitude against typical sources of error including non-response. The first member was chosen at random from the list of members in the designated five-state area. Then every third member was selected until the sample had reached the desired size.

Instrument Development

Given the purpose of the study, the research questions to be answered and the size of the sample, a mail questionnaire appeared to be the most economical and appropriate data collection technique. The instrument was developed through a careful examination of similar studies found in the review of literature. The instrument was designed to collect data as a self-administered questionnaire.

The instrument consisted of an 11 x 17-inch sheet of paper which was printed on both sides and folded into a four-page booklet. The body of the questionnaire was divided into three sections. In the first section, respondents were asked if their current position involved designing, delivering or managing training. At this point, individuals who were not currently working in the field of training and development were instructed to send back the survey without answering the remaining survey items. Respondents who were currently employed in the field were instructed to provide other demographic information, including their job title and the size and type of their organization, and to complete the remaining three pages of the survey.

The second and third pages of the survey contained a grid that listed 32 types of instructional technologies divided into categories. These categories included computer-based training systems, multimedia systems, electronic performance support systems, virtual reality, distance learning systems and computer presentation systems. Additionally, five areas were further divided into subcategories. In each category and subcategory, respondents were asked to identify if they used each technology in their training efforts and if they planned to use each technology in the next three years. They were also provided with an option to list additional technologies which were not included on the questionnaire.

In this same section, respondents were asked to assume that their organization planned to use each technology and to identify the levels of competency that would be needed to implement the technology. The levels included the ability to use or assist trainees in the use of a particular technology, the ability to assess the effectiveness of a technology, the ability to select a technology for an organization and the ability to develop a program or system using the technology. Respondents were allowed to select as many levels as they felt were appropriate.

Respondents were then asked to identify where they obtained or would plan to obtain competency in each technology. A list of training sources, including colleges and universities, technical colleges, seminars and conferences, vendor-sponsored training and self-study methods, was provided.

In the third section, printed on the fourth page of the survey, respondents were asked to identify barriers in the workplace which limited the use of instructional technology in training. In this section, respondents were provided with a list of potential barriers and were asked to indicate if the barriers were present in their work environment. These barriers included insufficient funding; hardware incompatibility; lack of management interest or support; lack of time, knowledge or technical skills among trainers; lack of interest among trainees; inadequate needs assessment; and lack of technical support. Respondents could also identify additional barriers if desired.

A cover letter was developed, printed and mailed with each survey. The cover letter explained the purpose of the study and the format of the questionnaire. It also emphasized the importance of respondent input and provided the name and complete address of the researcher. The cover letter also contained the informed consent information required by the researcher's university.

Data Collection

The 381 questionnaires were mailed with cover letters and postage-paid return envelopes on October 7, 1994. A pencil was included as incentive for individuals to respond to the survey. Seven of the surveys were returned to the sender due to an incorrect or outdated address. These individuals were removed from the sample, reducing the sample size to 374. Thirty percent of the sample, 112 individuals, returned the survey by November 5, 1994. On November 6, 1994, a second mailing, which included the questionnaire, a second cover letter, a postage-paid envelope, and a packet of instant coffee, was mailed to the remainder of the sample. By December 12, 1994, 49% of the sample, 184 individuals, had returned the survey. A phone follow-up was conducted between December 12 and December 16, 1994. An attempt was made to phone every individual who had not returned the survey. During the phone calls, individuals were asked several questions related to the use of instructional technology in training and reminded to send back the original survey.

As a result of the phone interviews, 54 additional people were removed from the sample because they were no longer employed at the organization listed in the directory. Thus, the final sample size was determined to be 320. Following the phone calls, another 15 surveys were returned. The final number of responses was 199, for a response rate of 62%. Of the 199 individuals who returned the survey, 52 individuals indicated that they were not involved in the design or delivery of employee training programs (mostly university faculty members, students and retirees) and did not complete all of the items on the survey. This left a total of 147 completed questionnaires to be analyzed.

Data Analysis

On December 23, 1994, the surveys were delivered to the University of Wisconsin-Stout's Academic Computer Center to be analyzed. The data were tabulated, and the surveys were returned to the researcher on February 3, 1995. In all sections of the survey, each item was analyzed in terms of frequency of each response and overall percentage for each option provided. In addition, Z-tests on the difference of proportions between the "yes" responses of current users and the "yes" responses of those who planned to use each technology were conducted to determine if there were significant differences between current and planned future usage. Chi-square tests were conducted to determine if there were significant differences between the various training sources selected by respondents.

Results

The results of the survey indicated that organizations are currently using a wide range of technologies, and there are 12 technologies that are currently being used by at least 50% of the respondents. These technologies include computer-based training, computer tutorials, computer simulations, computer presentation systems, presentation software, electronic performance support systems, on-line help systems, information databases, multimedia systems, LCD panels, LCD video/data projectors and local area networks.

These were the same technologies that 50% or more of the respondents indicated they plan to use in the next three years. However, respondents indicated that they plan to make significantly greater use of multimedia development and delivery tools including authoring programs, interactive video, CD-ROM, compact disk interactive and digital video interactive. They also indicate that they plan to use more complex technologies for their computer-based training and electronic performance support systems, including hypertext, expert systems, embedded/concurrent training, intelligent tutoring and virtual reality. There will also be greater use of computer conferencing to deliver training over distances.

According to respondents, there will be less use of certain types of distance learning systems, such as audioconferencing and one-way video. This would be logical as technology continues to evolve and provides more advanced, interactive systems for the delivery of distance education (Gery, 1994). There will also be a decrease in the use

of computer presentation systems to deliver classroom training. This decline will occur as companies abandon classroom training for more effective and cost efficient electronic instruction delivered at the desktop (Galagan, 1994).

The levels of competency required to implement instructional technology in training programs were consistent across 27 of the 32 types of technologies included in the study. Overall, respondents reported that the ability to use or assist trainees in the use of the technology was the most highly needed competency. The ability to evaluate the effectiveness of a specific technology was also frequently identified. The ability to develop programs or systems was identified by few respondents as being necessary for most technologies.

Vendor-sponsored training and self-study methods proved to be the most popular choices for developing competency in instructional technology. Attending seminars, conferences or workshops was frequently identified for developing competency in some technologies; however, it was not the primary method for competency development in any specific technology. Significantly fewer individuals indicated that they would attend courses and programs at universities, four-year colleges or technical colleges to develop their skills in any of the areas included in the questionnaire.

The respondents indicated that a lack of time and a lack of financial resources are the major barriers in implementing instructional technology in training efforts, as these barriers were cited by approximately 75% of the respondents. Lack of compatibility between systems, lack of management support, lack of technical support and lack of trainer skills are barriers that were identified by more than 50% of the respondents. These findings were consistent with the literature on this topic, which indicates there are several reasons why technology has not been fully integrated into training programs, including high costs, lack of management support and lack of skills among trainers (Gery, 1994).

Conclusions

From the findings of this study, it can be concluded that the major types of instructional technologies used in training and development will not change dramatically over the next three years. However, there are several newer, more sophisticated technologies that will be used with greater frequency in the future. The respondents' current and planned uses of instructional technology are consistent with other recent studies on this topic that indicate there will be a greater use of interactive technologies that will change how, when, and where trainees learn (American Society for Training and Development, 1994). It is predicted that in the future more companies will utilize digital multimedia technologies and individualized performance support systems to provide flexible training opportunities to workers (Galagan, 1994).

From the survey responses, it can be concluded that it is far more important for trainers to be able to use and evaluate new technologies than to be able to design and develop their own programs or systems. The data from the survey support the concepts found in the literature in this area. Past studies on this topic have concluded that trainers should be familiar with the applications of instructional technology; however, program or system development is generally done by computer programmers or media specialists with expertise in these areas rather than by trainers themselves (Spitzer, 1988).

It was determined by the respondents that vendor-sponsored training and self-study methods are the primary sources of competency development in instructional technology. Seminars, conferences and other training programs sponsored by professional organizations appear to play a lesser role, and universities and technical colleges appear to play a minimal role in providing trainers with knowledge and skills in computer-based training, multimedia systems, EPSS, distance learning systems or computer presentation systems.

Finally, it can be concluded that a lack of time and a lack of financial resources are the major barriers to implementing instructional technology in training efforts. Lack of compatibility between systems, lack of management support, lack of technical support and lack of trainer skills are also significant barriers. However, there does not appear to be a lack of trainee interest in using instructional technologies or a general lack of support for training efforts.

Recommendations

This study was designed to assist training professionals, human resource development managers, academicians and others who offer training and degree programs by providing information on how instructional technology is currently being used in training and how it may be used in the future. These various groups may find the results of this study useful in future planning efforts.

Recommendations for Practitioners

It is recommended that training professionals and their managers use the data generated by this study in defining current and future training needs and in identifying resources to obtain new skills and competencies in instructional technology. In particular, training professionals should become familiar with the technologies that are currently being used by more than 50% of the respondents' organizations. Training professionals, whether working in small, mid-sized, or large organizations, should also become knowledgeable regarding digital technologies and other emerging technologies that large numbers of organizations plan to use in the future. Skills in using computer systems and electronic support systems have been formally recognized as essential competencies for training professionals (McLagan, 1989). The shift from face-to-face training to delivering information during the performance of work will require all trainers to become familiar with numerous delivery technologies (Galagan, 1994).

The data from this study suggest that training professionals should focus on developing competency in the use and evaluation of the various technologies included in the survey. However, in a small number of organizations, it is also required that trainers select and develop programs and systems. In addition to learning about hardware and software, comments from respondents and the literature indicate that trainers also should possess competencies in using traditional media technologies. Trainers should also understand the process of applying appropriate instructional technology to performance problems (Piskurich, 1993).

Recommendations for Training Providers

The results of this study may also assist faculty in colleges, universities and technical colleges; directors of professional organizations; hardware and software vendors and others who provide courses, programs and training in the field of instructional technology. The majority of respondents in this study preferred vendor-sponsored training and self-study methods to meet their instructional technology training needs. However, several respondents indicated that they and their colleagues have not been trained in many aspects of instructional technology and lack the knowledge or skills necessary to be effective in this area. Therefore, it is recommended that vendors and organizations that provide self-study materials expand their offerings in instructional technology training, particularly in the area of emerging technologies to help address this unmet training need.

Although several post-secondary institutions offer programs in instructional technology, few trainers seem to be taking advantage of these offerings. It is recommended that undergraduate and graduate programs in training and development and instructional technology review their instructional technology courses and competencies in light of the findings of this study to ensure that their courses are relevant and appropriate for training professionals.

Due to inadequate budgets for equipment and laboratories, it is often difficult for colleges and universities to stay current with technology (Lindstrom, 1994). However, if universities and technical colleges are truly interested in meeting the instructional technology training needs of training professionals, it is recommended that they form partnerships with vendors or professional associations to assist in offsetting the costs of providing hardware and software training on college campuses.

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